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Front End Planning for Renovation and Revamp Projects: An Overview

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Front End Planning for Renovation and Revamp Projects: An Overview

**Prepared by
Construction Industry Institute
Front End Planning for Renovation/Revamp Projects Research Team**

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Executive Summary

Front end planning (FEP) is arguably the single most important process in the capital project life cycle. Known by many terms such as pre-project planning, front end loading, sanctioning process, programming/schematic design/design development, and others, front end planning creates the critical underpinning to any capital project. Front end planning is focused on creating a strong, early link between the business or mission need, project strategy, scope, cost, and schedule and maintaining that link unbroken throughout the project life. It has been considered a CII Best Practice for many years.

This summary focuses on recent CII research that shows the importance of the front end planning process with regard to renovation and revamp (R&R) projects. R&R projects are truly unique in terms of their singular planning aspects and risk exposure. A subset of R&R projects is shutdown/turnaround/outage (STO) projects, which were investigated as an important component of this work.

In this summary, results from 25 case study evaluations are presented from projects worth over \$1.4 billion. Additionally, statistical analysis of project data from the CII Benchmarking & Metrics database in excess of \$23 billion focusing on front end planning effectiveness on R&R projects is discussed. Results are also presented from four workshops focused on front end planning related STO projects, involving 67 industry participants from 39 organizations.

Data from the CII membership show that approximately 30 percent of expenditures on capital projects are focused on R&R work. Unique characteristics of R&R projects include:

- Safety and security issues of work force interfacing with existing operations
- Unforeseen site conditions more prominent
- Scope definition, estimating the amount of work more difficult
- Scheduling intensity, higher in many cases
- Shutdowns and maintenance work interface on many projects

- Greater need to interface with operations/tenants, maintenance, and construction personnel
- Additional schedule constraints occur due to operational interfaces
- Different funding sources, including both local capital and non-capital funds.

In addition to traditional front end planning issues for greenfield projects, planning teams must be concerned with the following issues as they effectively plan for R&R work:

- Stakeholder identification including existing operations personnel and/or tenants along with alignment and teambuilding of larger list of participants
- Defined front end planning process followed even if the project is small
- Adequate scope definition, including use of tools such as the Project Definition Rating Index (PDRI) and others
- Choosing the right contracting strategy to address the unique project drivers of R&R work
- Thorough investigation of existing conditions, including use of technology and field surveys
- Assessing the impact of labor and material availability in terms of the R&R work, especially for STOs
- Providing leadership and experience in key planning disciplines, particularly regarding issues unique to the R&R location and type of work
- Considering alternative execution practices, such as modularization and prefabrication during planning to enhance R&R project performance.

As part of this work, the existing PDRI tools that CII has for building and industrial projects were revised to reflect unique issues related to R&R projects. In addition, the research team developed a new tool: STAR (Shutdown Turnaround Alignment Review) for addressing STO projects

during front end planning. The team also developed Project Condition Investigation (PCI) cards outlining tools and techniques to enhance front end planning risk management. This summary provides an overview of tools and management practices that can be followed to help effectively plan for the issues outlined above.

Introduction

CII research has shown that approximately 30 percent of its owner members' annual construction-related capital expenditures involves renovation or "revamp" work rather than new construction, especially in North America. The U.S. Department of Commerce has estimated the cost of nonresidential renovation and revamp (R&R) projects in the U.S. at hundreds of billions of dollars annually. Consequently, a large volume of contractor work volume is in this arena, both in the U.S. and abroad. R&R projects make up the majority of those listed in the CII Benchmarking & Metrics database.

Approximately 30% of all project spending by CII members is on R&R projects, therefore this is an important area of concern for front end planning.

A renovation and/or revamp project is defined as one that is focused on an existing facility and includes the act, process, or work of replacing, restoring, repairing, or improving this facility with capital or non-capital funds. It may include additional structures and systems to achieve a more functional, serviceable, or desirable condition, including improvement in: profitability; reliability; efficiency; safety; security; environmental performance; and/or compliance with regulatory requirements.

Renovation and revamp projects also go under a great variety of other names, some specific to a sector of the industry or to a facility type. A small selection of such names might include:

- Retrofit
- Reconstruction
- Shutdown/Turnaround/Outage (STO)
- Maintenance project (not including routine maintenance activities)
- Modernization
- Improvement

- Repair project (not including routine maintenance actions)
- Alteration
- Rehabilitation
- Refurbishment
- Modification
- Upgrade
- Rebuild
- Overhaul
- Replacement
- Betterment
- Relocation
- Restoration
- Brownfield

These projects involve significant process, building, and/or infrastructure modifications to accommodate changes to facility operations. Examples include manufacturing process changes within an industrial plant to meet new product demand or to comply with regulatory requirements; shutdown or outage work within a power plant for maintenance or operational changes; or rearrangement of functions within commercial and institutional facilities such as office buildings, museums, hospitals, labs, and so on. Some of these projects are small, while others can be hundreds of millions of dollars in size.

Successful planning and execution of revamp/renovation projects present challenges unlike those of new construction and therefore require unique approaches. Such projects are fraught with the risk of unknown existing site conditions and are often, but not always, executed while a portion of the same facility must remain in operation. Despite these facts, project planning processes in some organizations are structured around new construction projects rather than revamps, as are most of the CII publications on front end planning (FEP). Absent the right approach, revamp or renovation projects can result in unwelcome surprises and disputes between the owner, design professional, and builder/contractor with delays and unwarranted cost increases.

Unique or increased risks exist for R&R projects when compared to greenfield projects.

Numerous risk factors need to be considered during front end planning efforts to support the success of renovation and revamp projects. All too often, stakeholders press for visible action as soon as project funds are approved. Such pressures, especially time and cost constraints from business drivers, pose added risks to the successful planning and execution of R&R projects. Other risk factors distinguish R&R projects from new (or “greenfield”) construction, including:

- Lack of detailed and/or accurate existing site condition information
- Difficulty of site safety planning in constrained environments
- Need for flexible contracting arrangements that support operations
- Need for detailed planning of subcontractor/multiple-prime coordination
- Need to plan swing-space requirements for personnel displaced by R&R
- Need for detailed traffic control plans
- Need for non-destructive testing and investigative technologies
- Lack of specialized craft labor availability during construction.

Figure 1 illustrates the three sub-phases of front end planning in context of the typical life cycle of a project. The diamonds in the diagram represent key decision gates that must be addressed prior to moving on to following phases.

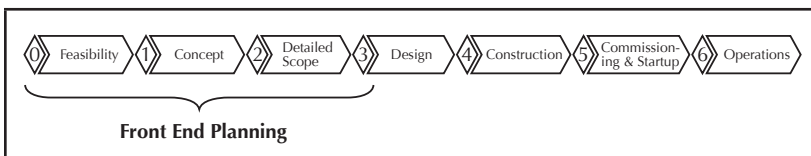


Figure 1. Front End Planning and the Project Life Cycle Diagram

Research Team 242

The purpose of this research was to offer support to the case for performing adequate front end planning on R&R projects. This objective was achieved through a four-phased data collection approach as well as tool development activities by the research team.

In the first phase, a survey of CII member organizations was conducted resulting in 41 responses, giving insight into the extent of R&R projects within respondents' capital portfolio during 2005-2007, along with their approach and critical issues of concern in performing these types of projects. During this time, the team established a definition of R&R and developed a list of risk factors unique to R&R projects that proved useful in follow-on work.

The second phase involved studying 25 R&R projects through case study analysis and focusing on how various forms of front end planning practices affect project success. The case study format was intended to supplement the statistical analysis by allowing managers reading the case studies to identify with the projects, situations, and decisions. Another advantage of the case study analysis is the ability to study inputs and outputs of front end planning that are tangible but difficult to quantify numerically. For example, strong leadership (or lack thereof) was easily recognized in the case study analysis, but would have been difficult to identify without direct discussions with the project participants. Using software analysis, patterns were revealed that linked project success to specific front end planning activities.

Using data collected by CII's Benchmarking & Metrics effort since 2002, the research team analyzed the front end planning practice use as well as project performance of over 650 projects worth over \$23 billion, including more than 500 R&R projects. The large majority of projects by number in the database was R&R projects and on average were smaller than greenfield construction.

The fact that more complete front end planning leads to more successful project outcomes had been established in an earlier CII investigation. The researchers compared the CII Pre-Project Planning Index to performance

metrics and between the subsamples of R&R versus new construction and investigated other practices such as safety, constructability, change management, and alignment.

Insights, critical success factors, and overarching lessons learned gained from these first three phases led directly to revision of existing CII front end planning publications and development of Project Condition Investigation (PCI) cards and the Shutdown Turnaround Alignment Review (STAR) Tool as outlined later.

The research team edited and modified three primary CII front end planning tools, the *PDRI for Buildings*, *PDRI for Industrial Projects*, and the *Front End Planning Toolkit*, to improve their usefulness. The team also developed CII Implementation Resource 242-2, *Front End Planning for Renovation and Revamp Projects*. As part of this new document, the research team investigated a range of existing tools and technological resources for Project Condition Investigation and developed PCI Cards that identify those that support FEP for R&R projects.

The final phase of the study involved development of the STAR Tool to assist project teams in assessing risk factors during FEP for STO projects. The team held a series of four workshops with 67 project owners and contractors to validate the scoring and weighting factors for the risk elements included in the STAR Tool. The attendees brought to the workshops a wealth of STO experience, providing insight from projects with an aggregate value of approximately \$5.5 billion; some of the attendees have subsequently made use of the STAR Tool on projects.

Regarding the *Front End Planning Toolkit*, the team decided that its message needed to be updated both in terms of content and format based on information developed in the interim since its publication in 2006. Version 2.0 of this tool integrates existing CII knowledge about front end planning.

Data Analysis Supporting Front End Planning for R&R Projects

Phase I Survey

The CII membership was surveyed concerning processes related to front end planning of renovation and revamp (R&R) projects. Forty-one organizations responded, representing a 40 percent response rate, including 24 owner and 17 contractor organizations.

The survey considered both the owner and contractor side of R&R projects as well as domestic and international work. It was divided into three sections:

1. Total budget for all projects, and the R&R budget in 2005 and 2006 with a projected budget for 2007 from owner respondents.
2. The revenue for all projects and the R&R revenue for 2005 and 2006 with projected revenue for 2007 from contractor respondents.
3. How or if the organization handles front end planning differently for R&R projects and if there are special characteristics of R&R projects.

Once the surveys were collected, descriptive statistics were calculated for the total budget/revenue and R&R project budget/revenue as illustrated in Table 1. During the three years encompassed by the survey, the average R&R dollar value project volume for owners was approximately 33 percent for owner organizations (\$1.5/\$4.6 billion), and revenues for contractors in the sample were approximately 29 percent (\$1.5/\$5.2 billion).

Approximately 30 percent of dollars spent on capital projects within this sample of CII members is focused on R&R projects. This snapshot points to the need to study front end planning of R&R projects in more detail.

Table 1. Mean Project Budget per Year for Owners and Revenue per Year for Contractors

Project Budget Type	Mean Budget Size (\$ Billion)
Owner's Total Project Volume	4.6
Owner's R&R Project Volume	1.5
Contractor's Total Project Revenue	5.2
Contractor's R&R Project Revenue	1.5

It should be noted that some of the projects budgeted by CII owner respondents were probably performed by CII contractor respondents. Based on the sampling method chosen there is no way to segregate these projects.

On average, R&R projects are smaller (less dollars spent), so the *number* of projects that are R&R in nature is probably more than greenfield. Although the survey attempted to get the number of projects, the respondents could not provide that data.

These data also showed that the volume of domestic R&R projects is higher than international projects for this subsample. For example, the domestic spending on R&R projects for owners was 47 percent of budget versus 29 percent of international capital budget. This seems to confirm that more R&R work is done domestically (in this case mostly North America) than internationally. This was a small sample and cannot be extended to the industry as a whole.

One specific finding of note from the survey was that the majority of the respondent organizations manage their R&R projects differently from greenfield projects because these projects typically contain more risk in such areas as safety, unknown site conditions, and interface with existing operations, as examples. The unique characteristics of R&R projects as opposed to greenfield projects identified by the respondents included:

- Safety and security issues of work force interfacing with existing operations
- Unforeseen site conditions more prevalent